PRESCRIPTION GLASSES WITH EYE GAZE TRACKING AND ELECTRO OPTICAL SIGNALING TO A HMD

CLAIM OF PRIORITY

[0001] The present application claims priority to and the benefit of the commonly owned Provisional Patent Application No. 62/566,282, with filing date of Sep. 29, 2017, and entitled "PRESCRIPTION GLASSES WITH EYE GAZE TRACKING AND ELECTRO OPTICAL SIGNALING TO A HMD," which is incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present disclosure relates to detecting a user who is wearing a head mounted display is also wearing prescription glasses, and determining gaze information of the user in order to improve quality of content provided for rendering on the head mounted display.

BACKGROUND

Description of the Related Art

[0003] The advancement in computer technology has led to advancement in cloud based processing, video game technology, etc. With the advancement in cloud based processing (i.e., using high powered graphics processors, memory, and other processing and communication resources), users are presented with an interactive experience that is both desirable and optimal. For example, cloud-based systems provide unlimited processing power and system resources for execution of interactive applications, such as video games. The cloud-based systems make an overwhelming breadth of legacy and new video games available for users to access and play the video games without having to upgrade their own devices. These cloud-based systems enable streaming of content to remote clients, wherein most processing is done on servers, which may be distributed. Cloud-based interactive applications, such as gaming, therefore, has been increasing in popularity because users find it easier to access more video game titles without complex hardware restrictions, and game suppliers find it easier to manage game code from centralized locations.

[0004] At a more personal level, devices are being developed to assist the users in selecting and interacting with content that is available on a remote server of a cloud-based system or on a local device, such as a game console or local computer. For example, head mounted displays have been developed and are increasing in popularity as it allows the user to have an immersive interactive experience, such as immersive gaming experience, by allowing the user to interact with content presented on a display of the head mounted display. Similarly, various input devices, such as controllers, have been developed to assist the user in providing inputs to the interactive content. The cloud system makes it easier to introduce newer devices as majority of the processing is done at the server level and newer devices can be easily integrated at the cloud level rather than at an individual system level.

[0005] Users that need to wear prescription glasses with their head mounted display (HMD) pose an extra challenge for the eye gaze tracking systems mounted in the HMD system, as it is hard to correctly gauge the direction of their gaze and other gaze-related information. This is because prescription glasses have lenses that are in-between the eyes of the user and the HMD system and these lenses of the prescription glasses create additional aberrations to images captured by eye facing cameras or other sensors of the HMD. These aberrations include defocus (making eye gaze tracking features blurry), geometric distortion (distorting the position or shape of eye gaze tracking features), reflections (adding unwanted features that could be falsely tracked by an eye gaze tracking system), etc. Further, the prescription glasses may move around slightly while a user wearing the HMD moves their head when interacting with content rendered on the HMD. This movement causes these aberrations to be dynamic in nature, making it more difficult for eye gaze tracking systems to calibrate away these aberrations.

[0006] It is in this context that embodiments of the invention arise.

SUMMARY

[0007] Embodiments of the present invention provide systems and methods for tracking eye gaze information of a user of a head mounted display (HMD) that takes into account prescription glasses worn with the HMD, by the user. The various implementations incorporate eye tracking system within the prescription glasses of a user instead of incorporating such tracking system in the HMD. This eliminates the aberrations caused by the lens of the prescriptions glasses that are in the path of image of the eyes of the user captured by the HMD's eye tracking system. The tracked data is forwarded to the HMD so that the image frames rendered on the HMD may be adjusted.

[0008] Broadly speaking, the various implementations disclose systems and methods for tracking eye gaze information of a user who is wearing prescription glasses (simply referred to as "glasses") with the HMD. The glasses include lens and eye tracking system components, circuitry disposed in a frame. When the glasses are worn by the user, the lens and the system components of the eye tracking system of the glasses detects presence of the HMD on the user, activates the necessary components (sensors, processor, emitter, etc.,) within the glasses to capture the gaze information of the user, and transmits a wireless signal that includes the gaze information to the HMD. The HMD processes the wireless signal received from the glasses to obtain gaze data, which is forwarded to a computing device for adjusting image frames that are generated from an interactive application for rendering on a display screen of the HMD. The HMD may, in turn, engage one or more image capturing devices (e.g., cameras) to track a physical position of the glasses in relation to the HMD. The gaze data captured by the glasses and the physical position of the glasses detected by the HMD are used to determine an area the user is focusing on, and use this information to adjust content of video frames generated for rendering on the display screen of the HMD.

[0009] To assist in tracking gaze information of the user wearing the glasses, the eye tracking system of the glasses includes one or more electro optical elements (e.g., light sources), a gaze sensor, a gaze processor and an emitter. The one or more electro optical elements, such as an infrared (IR) light emitting diodes (LEDs), are disposed on the frame of the glasses and oriented to illuminate eyes of the user, when activated. The gaze sensor is configured to capture images of the eyes of the user illuminated by the electro optical elements. The gaze processor is configured to pro-